

carry to you regarding the roads is appreciated and will be given due consideration.

The office equipment is about the standard equipment of any up-to-date office and therefore depends more or less on the volume of business which passes through your hands.

Data which was furnished by the U. S. Government at the National Road Show last week shows that there were only 44 yards of improved roads in the United States for each automobile and truck registered during 1927 and that this distance is rapidly diminishing each year. This proves that the burden is going to fall more and more on the county highway superintendents in the future. Therefore we must find means for making our dollars go farther as I believe that none of us, with the exception of an isolated case here and there, can see any more than a normal steady increase in the money which is to be given to us to expend. I challenge any one to get the full value out of these funds without efficient office help and equipment to produce accurate cost records.

In closing I might enumerate several things which office help will do for the county highway superintendents (any one of these items could very easily be the subject for a talk longer than the one I am now trying to make). They are as follows:

Free his mind of minute details.

Give taxpayer more confidence in the office.

Keep him advised regarding amount of his budget expended and unexpended.

Permit him to have "complete spare parts lists" properly catalogued and filed, for all of his equipment.

Allow him to know his costs exactly at the time that they are incurred, not after the tax board examines his expenses in the auditor's office.

Present his bills to the auditor promptly.

Answer his correspondence quickly.

Prompt reports to auditor, commissioners, etc.

Complaints will cease to annoy him so much if they can be made to his office at any time and when action is necessary it can be taken immediately.

ROAD PLANS AND SPECIFICATIONS

By E. L. Alexander,
Laporte County Engineer.

Before the Panama Canal became a reality it was dreamed of and planned in the mind of the engineer. The Wright brothers conceived the idea of the aeroplane. Elwood Haynes

dreamed of and planned the automobile. Marconi spent a great many years dreaming of and planning the wireless. All of these accomplishments were the result of intensive thinking and planning. No one person could have done these things alone, so it was necessary to draw plans and write specifications that would intelligently convey the idea to the person who is actually responsible for the work. The same thing is true in the construction of all highways, bridges, buildings and other types of construction work. This establishes the relation between the engineer and the contractor.

In order that the contractor may get the idea and clearly see the vision of the engineer it is necessary to supply him with a clear intelligent plan, otherwise he can not determine accurately what is to be done. He will not be able to make an intelligent estimate of what the work will cost. A good, reliable contractor hesitates to bid on a set of plans that are ambiguous for he is uncertain as to how the plans will be interpreted by the engineer. In one case the contractor's interpretation of the plan might cause his bid to be too high to receive the contract, in which case he has lost his time and incurred the expense of useless bidding. On the other hand his bid might be so low that faithful performance of the work as required by the engineer would be impossible without a financial loss. This might tempt him to slight the work, recouping his losses at the expense of others, and unless held under the strictest supervision a cheap type of construction would be the result. This misunderstanding as to the meaning of plans invariably causes trouble and loss to all parties concerned, and in a great many cases develops into expensive law suits.

In order to provide good plans for highway construction it is necessary first to make an accurate survey and obtain all data possible that will aid in preparing the estimate. Recognized standards and sizes should be adopted and used at all times. All horizontal and vertical curves should be figured and shown on the plan as well as points of intersection of grade lines with the per cent of grade plainly marked between such points. It is important for the contractor to know the maximum grades to aid in estimating the hauling costs. This is especially true if industrial equipment is to be used, for beyond a certain grade per cent such equipment is impracticable.

In drafting the plan it is absolutely essential that the work be done in a neat and workmanlike manner. The finished plan should present a clear illustration of the work to be done. There should be sufficient dimensions to enable the man in charge of the work to make his layout. All important dimensions and notes should be placed so that they stand out, thereby emphasizing their importance. Care should be used to thoroughly check all plans. The general appearance of the

plan depends very much upon the proper spacing of the different sketches, the use of a convenient scale and by all means the lettering. The title should contain all the information that is necessary to identify the plan, in other words the plan must be drawn by a good draftsman. It has been said that well made plans attract good contractors and poorly made plans attract poor contractors.

Specifications

The foregoing has dealt solely with plans, but plans alone are not sufficient in the successful development of a project. Specifications are equally as important and must accompany a good set of plans. Specifications are really an elaboration on the plans and everything relating to the work to be performed should be dealt with by them. It is not necessary for the specifications to be a literary masterpiece, but they should be written in a clear and concise manner that will positively and accurately describe the work to be performed and the material to be used. Clearness should not be sacrificed for brevity.

The specifications should start with a general description of the work to be done, its location and the general requirements relative to the payment of estimates, the maintenance of barricades and detour signs; after which should follow detailed specifications of the materials to be used and the work to be performed as they are encountered in their logical order.

In specifying the stone or gravel to be used in a contract it is not sufficient to simply state that the material shall be "acceptable to the engineer", but the writer should show the maximum and minimum sizes and the percentages that must be retained on the various screens, the hardness and coefficient of wear, and the maximum allowable amount of silt or loam or vegetable matter. In fact everything should be definitely specified so that the contractor may be able to examine the material he proposes to use and figure his costs accordingly. After the contract has been awarded there should be no misunderstanding or losses due to omissions or incomplete specifications.

Care should be used in the selection of words to express the meaning. For example it is very easy to use the word "or" when the real meaning requires the word "and". This is just one example of how a small detail might affect the contract. In drawing up the specifications, be very careful that you do not ask something that is impossible to perform, for specifications of this type will soon cause the contractor to disregard some of the other items and a gradual "letting down" will result.

In closing I wish to say that there has been a very decided tendency toward better plans and better specifications and the

results are noticeable in the work produced. The engineer who produces a good set of plans will inspire and maintain the confidence of all concerned, as it is only natural to expect that poorly drawn plans may result in careless execution of the work.

RECONSTRUCTING OLD ROADS TO MEET PRESENT DAY REQUIREMENTS

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The capacity of a pavement of any given width has been both theoretically and practically analyzed. Theorists have evolved formulae which give varying estimates, but are on the whole generally faulty in that they cannot take into consideration the personal equation. The writer has made many careful observations and has come to the conclusion from these observations, together with a study of the observations of others, that a one lane pavement has a practical capacity of about 450 vehicles per hour; a two lane pavement has a capacity of about 1,400 vehicles per hour; a three lane pavement has a capacity of about 2,000 vehicles per hour; and a four lane pavement a capacity of about 3,000 vehicles per hour. The figures given are exact for a two lane pavement, the actual maximum capacity in this case being in the neighborhood of 1,600 vehicles per hour. The figures given for the one lane pavement are meant to cover a single one lane pavement under average conditions of traffic going both ways, and does not represent two adjacent but separated one lane pavements. The figure given for the four lane pavement is approximate, while that given for the three lane pavement is theoretical.

There is little doubt but that ten feet is the practical width for one lane and multiples thereof for two or more. In the writer's opinion there is very little excuse for the construction of a three lane pavement, except that it be as a transitional type, so designed as to permit its completion as a four lane or its duplication as a dual three lane pavement. There has been considerable discussion in Ohio with reference to the construction of two twenties as against one forty. The capacity of two twenties would only be 80% of the capacity of one forty. There are occasions, however, where other conditions might intervene, making the two separated pavements desirable; the aesthetic, and presence of car tracks in the middle